HIGH SCHOOL AND UNIVERSITY
MATRICULATION EXAMINATIONS BOARD.

DEPARTMENTAL EXAMINATIONS, 1936

CHEMISTRY 1.

Time—2½ hours.

Note—Answer *question 1* and any other *seven* questions. Where diagrams are used, they should be neatly drawn and sufficiently large to show all necessary details.

In problems, show all steps in full; calculate results to one decimal place.

Atomic weights: H = 1; Ca = 40; C = 12; O = 16; N = 14; Cl = 35.5.

Values

1. The following is a list of experiments:

(1) Phosphorus is ignited and placed in a bottle of oxygen which is then covered.

(2) After all action has ceased in (1), water is added and the resulting solution tested with litmus paper.

(3) Air is passed over hot copper filings in a combustion tube.

(4) A mixture of manganese dioxide and hydrochloric acid is heated.

$MnO_2 + HCl$
$MnCl_2 + H_2O$
$+ Cl_2$

(5) A piece of sodium is dropped into water.

(6) Ferrous sulphide is treated with dilute sulphuric acid.

(7) A piece of calcium carbonate is heated to a high temperature.

(8) Copper is heated with nitric acid.

6 (*a*) In *each* of 1, 2, 3, 4, 5 and 8, state what should be observed.

8 (*b*) Write equations for the reactions in 1, 4, 5 and 6.

2 (*c*) Give a practical application for each of the reactions in 4 and 7.

Values

3 **2.** (*a*) Aluminium is *an element* having *an atomic weight of 27* and *a valency of 3.*

Explain what is meant by *each* of the italicized parts in the above sentence.

5 (*b*) Write the chemical formulae for any *five* of the following substances:

potassium sulphite, ferric chloride, bleaching powder, aluminium sulphide, ammonium carbonate, Chile saltpetre.

4 (*c*) Give the chemical name for the compound represented by each of the formulae: $MgSO_4$, Cu_2O, $Ca_3(PO_4)_2$, $Ba(ClO_4)_2$.

3. It is required to prepare and collect (1) a jar of oxygen from sodium peroxide, and (2) a jar of ammonia from ammonium chloride.

8 (*a*) Show by *labelled* diagrams *only*, the apparatus, materials and methods used.

4 (*b*) Write an equation for the chemical reaction in each of these processes.

2 **4.** (*a*) Give *two* characteristics of chemical compounds which distinguish them from mechanical mixtures.

6 (*b*) Explain and give an example of each of the following terms:

(1) synthesis.
(2) water of crystallization.
(3) allotropes.

4 (*c*) A metal *M* forms two oxides, one containing 22.53 per cent of oxygen and the other 30.38 per cent of oxygen.
Show clearly how the above oxides illustrate the Law of Multiple Proportions.

5. (*a*) 48 litres is the volume of a quantity of carbon dioxide when the temperature is 18° C. and the pressure 786 mm.

3 (1) What pressure will be necessary to change the volume to 20 litres, the temperature remaining constant?

5 (2) What temperature expressed in Centigrade reading, will be necessary to change the original volume to 40 litres, the pressure remaining constant?

4 (*b*) What weight of water is required to react with 7 pounds of calcium carbide?

Values

6 **6.** (*a*) Discuss Boyle's Law and Charles' Law in the light of the kinetic theory of gases.

6 (*b*) A gaseous compound is composed of 92.3% of carbon and 7.7% of hydrogen. One litre of it, at normal temperature and pressure, weighs 1.161 grams. Find the formula of the compound.

6 **7.** (*a*) Describe the construction of a chemical fire extinguisher. Explain clearly, using an equation to indicate the chemical reaction involved, what happens when it is used.

3 (*b*) Using an equation, explain why washing soda (sodium carbonate) is used for softening hard water.

3 (*c*) Give the composition of any type of baking powder and explain the use of each component.

5 **8.** (*a*) (1) Starting from sulphur, describe the contact process for the manufacture of sulphuric acid. Indicate an advantage and a disadvantage of this process.

3 (2) Write the equations for the reactions involved in (1) above.

4 (*b*) How is ammonium sulphate produced from sulphuric acid? Write an equation representing the reaction. What is the most important commercial use of ammonium sulphate?

9. (*a*) Sulphuric acid and common salt are heated together in a flask.

2 (1) Write the equation for the reaction which takes place.

4 (2) Give tests for proving the composition of the gas obtained.

6 (*b*) Outline experiments to show:

(1) the liquefaction of chlorine.

(2) the reaction of chlorine with metals.

(3) the oxidizing action of moist chlorine.

[OVER]

Values

10. (*a*) Carbon monoxide, sulphur dioxide, ammonia, hydrogen sulphide ,nitrogen and acetylene are gases at ordinary temperatures.

2 (1) Name the compounds formed when any *two* of these gases combine with water.

3 (2) Name the compounds formed when any *three* of these gases are burned in air.

1 (3) Name *one* of these gases which acts as a reducing agent.

3 (4) Give a commercial use for each of any *three* of these gases.

1 (*b*) (1) Give one *chemical* similarity between nitrous oxide and oxygen.

1 (2) How may these gases be distinguished from each other?

1 (*c*) Give a chemical property of carbon dioxide which distinguishes it from nitric oxide.

12 **11.** Discuss at length the topic "Chemistry in Modern Life".

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